

*espica* ✦

# LIGHTING DESIGN HANDBOOK

A MANUAL FOR ARCHITECTS AND SPECIFIERS



Light is more than illumination. It is **an architectural material**. In the hands of a skilled designer, lighting defines form, evokes emotion, and enhances the human experience of space. The **Lighting Design Handbook for Architects and Specifiers** is a practical guide created to inspire and support professionals in shaping environments through light.

Developed by Espica, a European manufacturer with a strong design heritage and a commitment to innovation, this handbook bridges **technical expertise with creative vision**. Whether you're working on residential, commercial, or public architecture, this guide will help you make informed, impactful decisions rooted in quality, efficiency, and design excellence.

With a focus on real-world application and adaptability to regional markets like the UAE, this publication empowers you to deliver **lighting solutions** that are both visionary and viable.

**INDEX**

1. The power of light in architecture	5
2. Glossary of light	9
3. Principles of lighting design	12
4. Lighting standards	18
5. Solutions for the Middle East Context	21



# **THE POWER OF LIGHT IN ARCHITECTURE**



Light is a fundamental element of architecture, one that transcends mere functionality to become **a language of form, rhythm, and emotion**. It reveals textures, defines spatial hierarchies, and guides movement through a space. Thoughtful lighting design elevates architecture, turning static structures into dynamic experiences. This chapter introduces **the principles behind using light as a creative medium**, illustrating how natural and artificial lighting can be integrated to reinforce architectural intent. Through a selection of **case studies and cross-cultural references**, we highlight how light can shape perception and create meaningful, context-sensitive environments.



# CASE STUDIES



## Therme Vals – Peter Zumthor

**Concept:** Light as atmosphere

**Natural Integration:** Carefully placed skylights allow daylight to pour in like shafts of light, creating a sacred, almost cavernous experience.

**Artificial Integration:** Hidden indirect lighting reinforces the meditative mood at dusk, emphasizing texture and shadow.

**Architectural Intent:** To evoke the feeling of bathing in a timeless, elemental space — light becomes the interface between nature and stone.



## Louvre Abu Dhabi – Jean Nouvel

**Concept:** “Rain of Light”

**Natural Integration:** The perforated dome filters daylight to create dappled patterns that mimic the shadows under palm trees.

**Artificial Integration:** Subtle uplighting and concealed fixtures maintain the softness of the effect at night.

**Architectural Intent:** To blend traditional Arabic shading techniques with contemporary museum design — light is both functional and poetic.



## Rolex Learning Center – SANAA

**Concept:** Fluid openness

**Natural Integration:** Large glazed façades and open-plan layout allow diffused daylight throughout the building.

**Artificial Integration:** Linear and recessed fixtures follow the architectural curves, maintaining flow and spatial continuity.

**Architectural Intent:** To create a seamless learning environment where light supports visual comfort, transparency, and calm.



## Kimbell Art Museum – Louis Kahn

**Concept:** Light as structure

**Natural Integration:** Vaulted ceilings with narrow slits admit natural light, diffused by reflectors for uniformity.

**Artificial Integration:** Custom-designed fixtures align with the architecture, maintaining the purity of form.

**Architectural Intent:** To illuminate artworks without distraction — light is part of the building's structure and soul.



## The Al Bahar Towers – Aedas Abu Dhabi

**Concept:** Adaptive shading

**Natural Integration:** Responsive façades with mashrabiya-inspired panels adjust to sunlight levels, reducing glare and heat.

**Artificial Integration:** LED lighting is embedded into the façade and interiors for nighttime performance and identity.

**Architectural Intent:** To fuse Islamic design heritage with advanced environmental controls — light and shadow become dynamic building materials.



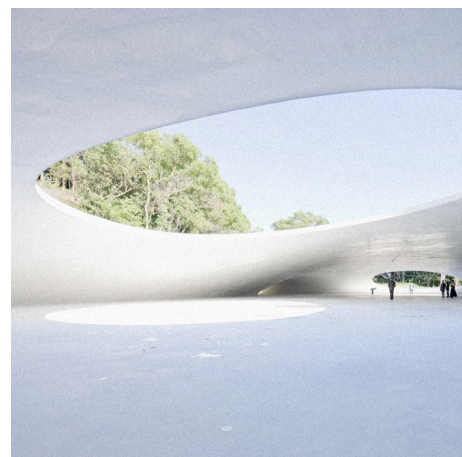
## Teshima Art Museum – Ryue Nishizawa & Rei Naito

**Concept:** Pure presence

**Natural Integration:** Openings in the concrete roof frame the sky, allowing ever-changing natural light to animate the interior.

**Artificial Integration:** Almost none — light control relies almost entirely on the natural cycle.

**Architectural Intent:** To erase the boundary between art, space, and nature — light itself becomes the “artwork.”

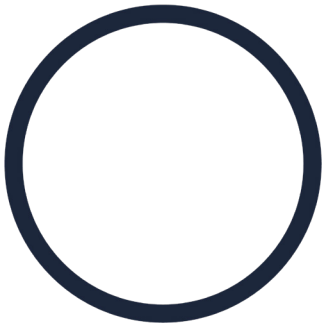




# **GLOSSARY OF LIGHT**



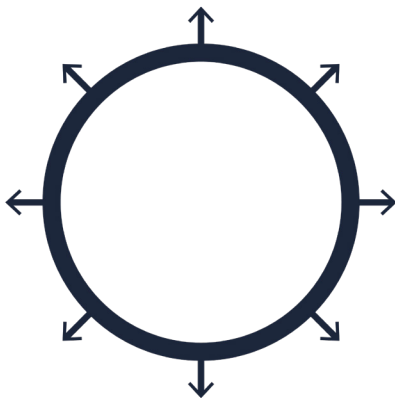
# GLOSSARY OF LIGHT



## Light source

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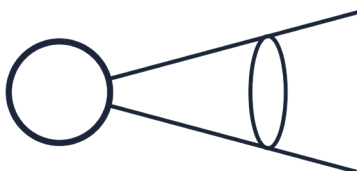
A light source is **any object or device that emits visible light**, either naturally or artificially. In architectural and lighting design, light sources are critical elements used to illuminate spaces, influence mood, and enhance functionality.



## Luminous flux

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Luminous flux is **the total amount of visible light emitted by a light source per unit of time**, measured in lumens (lm). It represents the perceived power of light by the human eye, only the wavelengths that we can see. Luminous flux does not indicate how bright the light appears in a specific direction (that's luminous intensity), but rather the overall output. It is used to compare the efficiency of different lighting products — more lumens with less energy means higher efficiency.

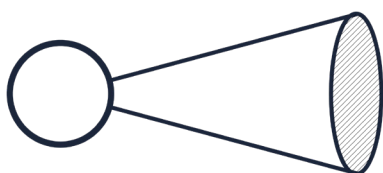


## Luminous intensity

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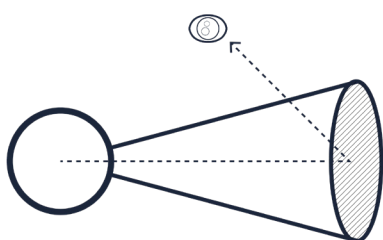
Luminous intensity is **the amount of visible light emitted by a source in a particular direction**, measured in candelas (cd). It describes how concentrated the light is in a specific angle, rather than how much total light is emitted (which is measured by luminous flux in lumens). It is especially important for directional lighting such as spotlights, floodlights, or accent lighting. The same light source can have different luminous intensities depending on the beam angle — narrower beams produce higher intensity.





## Illuminance

Illuminance is **the amount of light falling on a surface, measured in lux (lx), where 1 lux equals 1 lumen per square meter**. It describes how well-lit a surface is, such as a desk, floor, wall, or work area. Unlike luminous flux (total light emitted) or luminous intensity (light in a direction), illuminance focuses on the surface receiving the light. It depends on both the strength of the light source and the distance and angle at which the light hits the surface.



## Luminance

Luminance is **the measure of the brightness of a surface as perceived by the human eye**, expressed in candelas per square meter ( $\text{cd/m}^2$ ). It indicates how much light is emitted, transmitted, or reflected from a surface in a specific direction. Unlike illuminance (light falling on a surface), luminance measures the light that is visible from the surface. It directly affects how bright or comfortable a surface appears, and plays a critical role in visual perception, contrast, and glare control.



# **PRINCIPLES OF LIGHTING DESIGN**



Effective lighting design blends aesthetics, function, and technical precision. This chapter outlines the foundational principles that guide successful lighting strategies: **colour temperature, beam distribution, and control systems**. Understanding these elements enables architects and specifiers to create environments that are visually comfortable, energy-efficient, and tailored to the intended use of space. From ambient to task and accent lighting, we highlight **how to balance performance with atmosphere**. Special attention is given to the role of adaptive technologies and smart controls — vital for optimizing energy use and ensuring compliance with sustainability goals in the UAE.

# COLOUR TEMPERATURE



**WARM LIGHT**  
2700K / 3000K

Measured in Kelvin (K), **colour temperature defines the appearance of light**, ranging from warm (yellow/orange tones) to cool (blue tones). Warm light (2700K–3000K) creates a cozy, intimate atmosphere, ideal for residential and hospitality settings. Cool light (4000K–6500K) enhances alertness and visibility, making it suitable for workplaces and healthcare environments.

**COOL LIGHT**  
6500K



# BEAM DISTRIBUTION

Beam distribution describes **how light spreads from a fixture**. It can be narrow (spot), medium (flood), or wide (wide flood), or dedicated to particular applications (such as asymmetric or elliptical) affecting how focused or diffuse the light appears. Choosing the right beam angle ensures even illumination, prevents glare, and enhances spatial dynamics.

## NARROW

A narrow beam refers to a **focused light distribution from a lighting fixture**, typically with a beam angle between 10° and 25°. This means the light is concentrated into a tight cone, producing **high luminous intensity in a small area**.

### Key Characteristics:

- / High contrast between lit and unlit areas
- / Sharp-edged beam with minimal spill light
- / Used to highlight specific objects or features
- / Often used in accent, display, or directional lighting

### Typical Applications:

- / Spot lighting artwork or sculptures in galleries and museums
- / Retail displays to draw attention to featured products
- / Architectural highlighting of columns, textures, or signage
- / Theatrical or stage lighting for focused illumination
- / Landscape lighting to emphasize trees, statues, or façades



**FELIS**  
narrow optic 15°

## MEDIUM

A medium beam refers to a **light distribution with a beam angle typically between 25° and 40°**. It provides a balanced spread, more focused than wide beams but broader than narrow beams, making it ideal for **general accent lighting and controlled ambient lighting**.

### Key Characteristics:

- / Provides moderate spread and intensity
- / Suitable for highlighting larger objects or areas
- / Offers less contrast than a narrow beam, but still directs attention
- / Versatile for both task and decorative lighting

### Typical Applications:

- / Accent lighting for furniture, signage, or artwork in larger spaces
- / Retail and hospitality lighting for product zones or displays
- / Task lighting in kitchens, offices, or reading areas
- / Architectural lighting for pillars, niches, or textured walls
- / Track lighting in galleries or commercial interiors



**VENUS**  
medium optic 36°



**FELIS IP RATED**  
wide optic 55°

## WIDE

A wide beam refers to a **light distribution with a beam angle greater than 40°**, often ranging from 45° to 90° or more. This type of beam spreads **light over a broad area**, offering soft, even illumination rather than focused intensity.

### Key Characteristics:

- / Low contrast, wide spread
- / Ideal for general lighting, ambient illumination, or large-area coverage
- / Provides uniform light levels, minimizing harsh shadows
- / Less directional, more diffused compared to narrow or medium beams

### Typical Applications:

- / Ambient lighting in open-plan offices, retail spaces, and hospitality
- / Residential lighting for living rooms, kitchens, and bedrooms
- / Large surfaces such as walls, ceilings, or open display areas
- / Outdoor lighting for wide landscape washes or architectural façades



**LYNX-in 2**  
elliptical optic 50°x20°

## ELLIPTICAL

An elliptical beam is a **type of light distribution shaped like an elongated oval**, projecting light more widely in one axis (horizontal or vertical) than the other. Unlike circular beams, elliptical beams are designed to cover long, narrow areas efficiently without spilling light where it's not needed.

### Key Characteristics:

- / Asymmetric light spread, typically 10°x60° or similar
- / Ideal for wall washing, corridors, signage, or architectural lines
- / Minimizes glare and improves uniformity across linear surfaces
- / Can often be rotated or adjusted to align with specific design needs

### Typical Applications:

- / Wall washing in galleries, museums, and hotels
- / Linear features like pathways, staircases, or display shelving
- / Retail shelves or vertical banners
- / Architectural lighting for columns or narrow façades



# CONTROL SYSTEMS

Lighting controls manage **how and when lighting operates**. They range from basic dimmers and timers to advanced systems like occupancy sensors, daylight harvesting, and smart building integration. Proper controls enhance energy efficiency, support user comfort, and adapt lighting to time of day, occupancy, or activity. Find in here the ones Espica is using in its products.



## PHASE DIMMING

Phase dimming, also called phase-cut dimming, is a **method of controlling the brightness of a light fixture by cutting parts of the AC voltage waveform**. It is commonly used with LEDs, incandescent, and halogen lights, and is compatible with many trailing edge (ELV) or leading edge (TRIAC) dimmers.

### Key Features:

- / Works with standard wall dimmers
- / No additional control wiring (unlike 0-10V or DALI)
- / Dimming range depends on driver compatibility
- / Typically offers flicker-free dimming with high-quality drivers



## DALI

DALI dimming refers to light control using the Digital Addressable Lighting Interface (DALI), an **open, standardized digital protocol** (IEC 62386) used for controlling lighting systems. DALI allows for **precise, addressable dimming of individual fixtures or groups, with bidirectional communication between lights and controllers**.

### Key Features:

- / Digital control: Each fixture has a unique address
- / Smooth dimming: Typically down to 1% without flicker
- / Two-way communication: Fixtures can report status (on/off, errors, dim level)
- / Centralized or decentralized control
- / Supports automated scenes, schedules, and daylight/occupancy sensors
- / Ideal for large, complex, or smart lighting installations

### Benefits:

- / Highly scalable and flexible
- / Energy-saving through intelligent control
- / Can be integrated into BMS (Building Management Systems)
- / Suitable for offices, airports, museums, hospitals, smart homes

# **LIGHTING STANDARDS**



# STANDARD VALUES FOR LIGHTING

Tables were taken from the European standards.

Lighting of indoor workplaces / EN 12464-1 (June 2011)

Lighting of outdoor workplaces / EN 12464-2 (October 2007)

Illuminance levels must **not fall below the  $\bar{E}_m$  maintenance values** in the visual task area. If the precise location is not known, the limit should be applied to the whole room or a specific working area.

These values are indicative and should be considered as **suggestions from the regulations**, therefore they are expressed in ranges within which the illuminance values should be included for correct lighting.

**Standard Illuminance Values (Indoor)**

(Lux = lumens per square meter)

Application Area	Recommended Lux Level
Residential- Living Room	100–300 lx
Residential- Kitchen	300–500 lx
Residential- Bathroom	200–300 lx
Office- Open Plan Workstations	300–500 lx
Office- Meeting/Conference Room	300–500 lx
Office- Reception Area	200–300 lx
Classroom / Educational Room	300–500 lx
Library Reading Area	500 lx
Hospital- Examination Room	1,000 lx
Corridors and Hallways	100–200 lx
Stairways	100 lx
Retail- General Areas	500 lx
Retail- Product Display Areas	750–1,000 lx
Restaurants (ambient)	100–300 lx
Hotels- Lobby	200–500 lx

**Standard Illuminance Values (Outdoor)**

Application Area	Recommended Lux Level
Pedestrian Pathways	5–20 lx
Residential Street Lighting	5–15 lx
Commercial Parking Lot	20–50 lx
Building Entrances	50–100 lx
Architectural Façade Lighting	50–200 lx (varies by effect)
Stadium / Sports Field	500–2,000 lx
Gas Stations (under canopy)	300–750 lx
Outdoor Dining Areas	50–150 lx



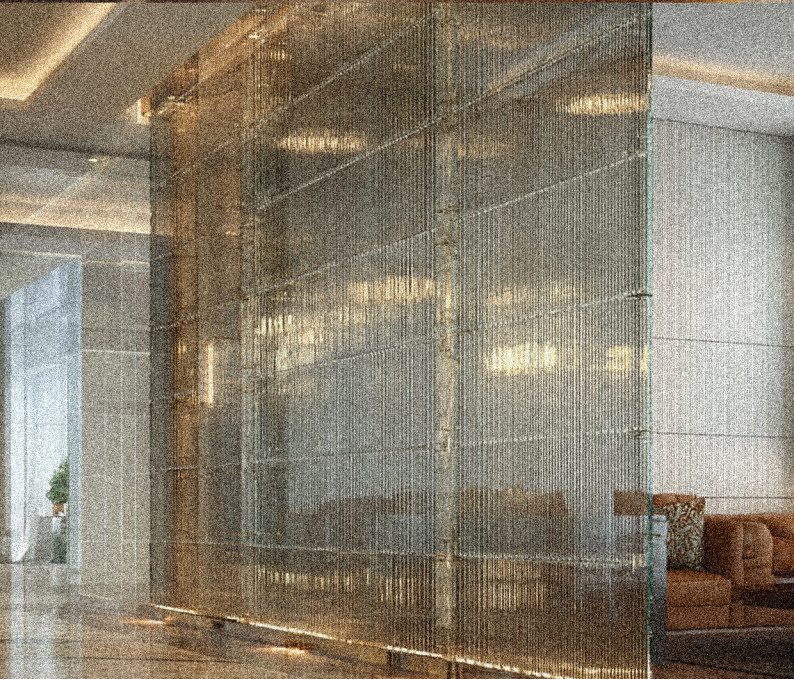
# **SOLUTIONS FOR THE MIDDLE EAST CONTEXT**

Designing with **artificial light in the Middle East** requires a nuanced approach that respects climate, culture, and architectural heritage. The region's intense sunlight, high ambient temperatures, and long daylight hours shape distinct lighting demands, especially when transitioning from outdoor to indoor environments. **Glare control, thermal management, and energy efficiency** are crucial, particularly in glass-heavy modern buildings and traditional structures alike.

Lighting solutions must balance **functionality with cultural aesthetics**, from creating atmospheric majlis lounges to illuminating mosques, museums, and public spaces with sensitivity and precision. Advanced LED technology with high efficacy, smart controls, and DALI systems allow tailored lighting scenes that respond to time of day, user needs, and sustainability targets.

Solutions should emphasize **low glare optics, indirect illumination, and colour temperatures** that complement both the desert landscape and interior finishes. Integration with daylight harvesting systems can reduce energy loads in compliance with Estidama, LEED, or Saudi Vision 2030 goals. Ultimately, thoughtful lighting design in the Middle East must merge performance, resilience, and beauty, creating environments that are as sustainable as they are inspiring.









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